Lithium isotope ratio of samples collected from salt lakes at Nevada, USA: Implication for lithium origin in salt lakes

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Lithium is a useful and worth element for industrially purposes. Lithium has unique characteristics such as lowest Oxidation-reduction potential among all elements and the third-lightest element after hydrogen and helium. These properties are valuable for lithium-ion secondary battery that is non-memory-effect, high-power and the highest energy density among batteries in practical use.

Salt lakes are the most major lithium resources on earth. Highly concentrated lithium resources were formed in salt lakes by repetition of water evaporation and inspissation with an arid climate. As a result of rising consumption of lithium carbonate, lithium-rich brine in salt lakes have been developed all over the world. Therefore, it is essential for revealing the origin of highly concentrated lithium in salt lakes for future exploration.

Lithium isotope ratio is known for newly useful tool understanding water-rock interaction. Moreover, lithium isotopic fractionation is dependent on temperature and its compositions are strongly affected by initial values of host rocks. We report lithium and strontium isotope ratio, as well as major and trace element compositions, of samples collected from some salt lakes at Nevada, USA. These lithium isotopic values (δ^7Li) of samples have a large variation among each sample, however all the values are much lower than the values of river water reported previously [1], and are close to values of upper continental crusts [2]. These results suggest that highly concentrated lithium in salt lakes were not formed during surface weathering processes, but were supplied by the result of water-rock interaction below the surface of the earth at high temperature.

We demonstrated that lithium isotope ratio has a potential for tracing lithium origin in salt lakes and further detailed studies must be required such as the values of host rocks.

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Mg/Ca Paleothermometry in *G. ruber* (white): mechanisms and calibration

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Abstract

Paired planktonic foraminiferal Mg/Ca and δ^{18}O analyses are frequently applied to jointly estimate sea surface temperature and δ^{18}O$_{seawater}$, a proxy for ocean salinity. The relationship between shell Mg/Ca and temperature is rooted in thermodynamic theory; Mg/Ca increases as temperature increases as a result of the endothermic substitution of Mg^{2+} into the calcite lattice[1-2]. While temperature has previously been indicated as the main controlling factor in foraminifera, there is significant biological mediation[1,3-6].

Recent results suggest that ocean salinity may also be a significant influence on shell Mg/Ca ratios[7-9]. This influence was noted in our findings from an Atlantic meridional coretop sample transect, where we found that *G. ruber* (white) shell Mg/Ca values were significantly elevated in higher salinity gyre waters. This "excess Mg/Ca" (the residual between the observed and expected Mg/Ca composition at the δ^{18}O calcification temperature) is well correlated with surface salinity[7]. We investigated the nature of this "excess Mg/Ca" signal for the planktonic species, *G. ruber* (white). We employ multiple techniques including scanning electron microscope imaging, flow through ICP-MS, and electron microprobe elemental mapping, with a goal of separating potential mechanisms for the observed enhanced uptake of shell Mg/Ca at high salinity.

In addition, we will present our latest global calibration efforts. Our global database consists of 301 coretops, and is growing, composed of both new and published data for the surface-dwelling planktonic foraminifer, *G. ruber* (white). We use multivariate regression analyses to produce new global equations relating shell Mg/Ca, δ^{18}O, and bottom water ΔCO_3^{2-} to ocean temperature and salinity. Our goal is to better understand how environmental (and biological) conditions influence shell chemistry and to use this knowledge to improve calibration equations. We will discuss the validation of these new equations and their applicability to downcore paleoclimate reconstructions.

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